

How to measure S11 at around 2.45GHz Range with the VNWA3 and VNWA2

Preface:

I recently acquired some filters for the WiFi Band (2.401 to 2.467 GHz) and was interested in seeing how the VNWA would perform using a 2448MHz Bandpass filter with 100MHz bandwidth (covering channel 1 to 11) in series with the TX port, during S11 calibration. The measurement method for the experiment is to use the VNWA in mode External Bridge and by using a simple SMA T-connector as the bridge. This should allow measurement in the range from a few ohm up to a few hundred ohm. At least it should work OK in the 50 ohm range.

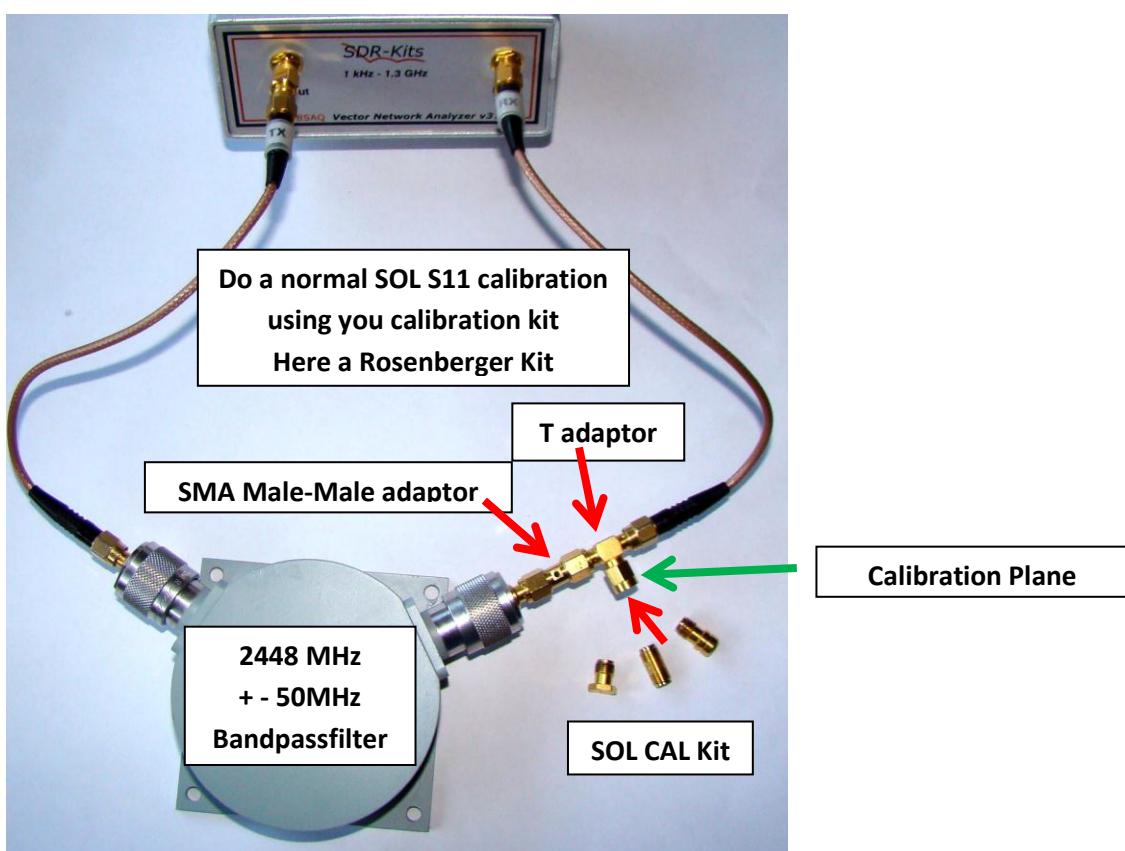
As the VNWA has a spectrum with zero power at the RF and LO DDS clock frequencies (Fc in the following) and their multiples, then the maximum power will be in between e.g. 3 x Fc and 4 x Fc for the 2.4GHz range when running the two DDS at maximum possible clock frequencies. For the WiFi bandpass filter with center freq of 2438MHz will a division of 3.5 give 697MHz and by selecting RF and LO DDS clock frequencies on either side of 697MHz we will have good output power for the entire WiFi band.

For the premultiplier of x 3 the RF DDS multiplier x 20 gives a RF DDS clock of 720MHz and likewise with a LO DDS multiplier of x 19 gives a LO DDS clock of 684MHz.

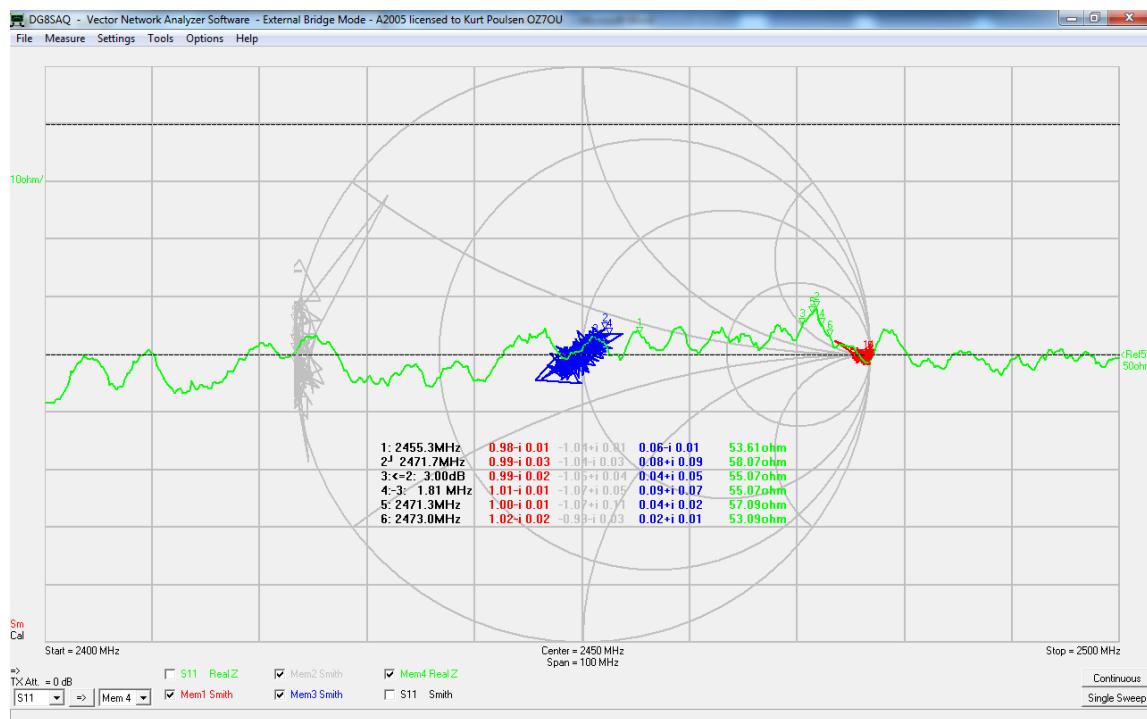
If by using x 19 for the LO DDS and x 20 for the RF DDS might be better but not investigated yet. These setting for VNWA3 but the VNWA2 has identical setting possibilities.

The test method in details:

- The VNWA mode external bridge selected.
- Test cables fitted to the TX and RX port
- At the end of the TX port test cable is the 2448MHz 100MHz bandwidth filter fitted
- from the output of the filter to the RX port test cable is fitted a T-adaptor where on the “third leg” the calibration is performed with the SOL test kit.
- The frequency span selected is the filter bandwidth 2400 to 2500MHz (to keep the signal clean but a wider range can be used e.g. to the -6dB limits)
- Sweep set to 500 points and 100mS per point



Measurements after calibration of Short, Open and Load



MEM1(red trace) = Open, MEM2(gray trace)=Short and Load(blue trace)=Load.

Open and Short compensated for the open and short delays. Real Z(green trace)=50 ohm 10ohm/div at 5 division

Final comment:

A quite useable setup for measuring WiFi antenna impedances.

Use of highpass filter as substitute for bandpass filter might give acceptable result, but the bandpass filter method is to prefer.

The concept can be used for other frequencies as well and with better performance the lower the required frequency range.

Have fun with your experiments

20/08/2012

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